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the reader to supplement the necessarily brief discussion of such topics. The apparatus for experimental work is well selected, and gives opportunity for typical demonstrations on almost every problem, with a minimum of cost, while many additional exercises are given, for which no special apparatus is needed.

H. C. WARREN.

SCIENTIFIC JOURNALS.

Journal of Physical Chemistry, May. 'The Transference Number of Hydrogen:' by Douglas McIntosh. An attempt to determine the transference number for hydrogen in different circles by the Helmholtz method, using gas electrodes, but it was found that the method is not applicable to gas cells, probably owing to the solubility of the electrode in the electrolytic solution. 'Single Differences of Potential:' by Hector R. Carveth. The conclusion is drawn that the values given by drop electrodes does not give true single differences of potential. 'Acetonechloroform:' by Frank K. Cameron and H. A. Holly. A study of the camphor-like substance discovered by Willgerodt formed by adding potassium hydroxid to a mixture of acetone and chloroform. From the formula of the substance it would appear to be a simple addition-product, but this is shown not to be the case, and it cannot be resolved into its constituents by direct means. While the substance contains water, it is present not as a hydrate, but apparently in a solid solution. Notes on new books, including an excellent review of the last edition of Mendeléef's Principles of Chemistry; Journal Reviews.

THE *Astrophysical Journal* for May, completing the seventh volume, opens with an article by Professor J. Wilsing, of the Potsdam Astrophysical Observatory, which argues that the results obtained by Messrs. Humphreys and Mohler on the influence of pressure on the wave-length of lines in the spectra of the metals can be explained as an effect of damping of the vibrations to which the emission of light is due. Mr. R. H. Tucker, of the Lick Observatory, follows with an article on 'The Correspondence of the Photographic Durchmusterung with the Visual.' Mr. C. W. Crockett, of the

Rensselaer Polytechnic Institute, reviews in two articles the caustic of the right parabolic cylinder and the parabolic mirror. Mr. Frank McClean contributes a paper read before the Royal Society on a comparison of oxygen with the extra lines in the spectra of the helium stars, as also a summary of the spectra of southern stars, and Professor H. A. Rowland and Mr. C. N. Harrison contribute the final article on 'Arc Spectra of Zirconium and Lanthanum.'

THE sixteenth volume of the *Educational Review* commenced with the June number, which includes the following articles: 'Harris' Psychologic Foundations of Education,' by John Dewey; 'Scope and Function of Secondary Education,' by Nicholas Murray Butler; 'Teaching European History in College,' by James H. Robinson; 'Religious Periods of Child-growth,' by Oscar Chrisman; 'Better Training for Law and Medicine,' by Charles F. Thwing; 'The Key to Rousseau's Emile,' by Samuel Weir, and 'Attitude of Massachusetts School Authorities toward a Science of Education,' by John G. Thompson.

SOCIETIES AND ACADEMIES.

THE CHEMICAL SOCIETY OF WASHINGTON.

THE regular meeting was held on April 14th.

The first paper of the evening was read by Dr. Hillebrand and was entitled 'The Volumetric Estimation of Vanadium in the Presence of small Amounts of Chromium, with especial Reference to the Analysis of Rocks and Ores.' When chromium has been estimated colorimetrically, as detailed in a previous paper, the vanadium can, in many instances, be estimated without separation from the chromium by the well-known method of titration with KMnO_4 . With considerable chromium present the error is increased by the difficulty of getting sharp end reaction, due to the color of the chromic salt and to the oxidizability of Cr_2O_3 in hot solutions, but the author shows how to ascertain and apply a proper correction within certain limits.

The method is especially applicable to rocks, iron ores, clays, coals, etc., in which chromium is seldom an important constituent quantitatively.

Tables of numerous test trials on prepared solutions containing from one to 87.5 mg. Cr_2O_3 and from one to 47 mg. V_2O_5 showed errors, with two exceptions, of much less than $\frac{1}{2}$ mg. and establish the method as trustworthy in competent hands.

A further table showed the applicability of the method to ores and rocks to which known amounts of Cr_2O_3 and V_2O_5 had been added. These were fused together with sodium carbonate and nitrate; the silica and alumina were removed from the alkaline extract; phosphorus, chromium and vanadium were thrown down by $\text{Hg}_2(\text{NO}_3)_2$; the mixed precipitate was ignited; the residue refused with a little sodium carbonate, and in the resulting aqueous extract both chromium and vanadium were estimated, the results being equally as good as those obtained with simple solutions.

The author suggested that the reaction of H_2O_2 on Cr_2O_3 and V_2O_5 in the presence of ether might be utilized to remove the greater part of the chromium prior to titration of the vanadium, since the oxidation product of chromic acid dissolves in the ether, while that of vanadic acid does not; also that the brown color produced in vanadic solutions by H_2O_2 might be made the basis of an exact colorimetric method for the estimation of vanadium.

The next paper was presented by Dr. de Schweinitz and Mr. Marion Dorset and was entitled 'The Mineral Constituents of the Tubercle Bacilli.' The authors, in continuation of their work upon the study of the tubercle bacilli, made a careful analysis of the ash and found a very large percentage of phosphates, calcium, magnesium, potassium and sodium. They pointed out the apparent close connection between the high content of fat and phosphates in the body of the germ and the method of treating tuberculous patients with codliver oil and phosphates. The work is being continued now in the direction of a careful study of the albuminoids of the germ.

Mr. Fireman presented a paper on 'Some Observations on the Centric Benzene Formula and the Aromatic Character.' The centric formula is ascribed to the unreduced ring, while to the partially reduced ring a structure with the double bonds in the ordinary sense is at-

tributed. The transformation of the unreduced into the reduced ring and *vice versa*, as well as the transformation of the ring with the centric structure into the ring with the double bonds and *vice versa*, must be recognized as a characteristic feature of benzene and its derivatives, the aromatic compounds. If this is so, then the centric formula is inapplicable to a ring of either 5, 7 or any odd number of carbon atoms, reduction of such rings being impossible, since the valencies could not be satisfied in case of reduction. Hence the rings of 5 and 7 carbon atoms nearest to benzene in the number of members of the nucleus can not be expected to be endowed with an aromatic character. On the other hand, assuming, as we must, that the tension in the benzene ring, due to the closing of the latter, is small, then a ring of 4 or 8 carbon atoms would similarly have too much tension, which would be incompatible with such a degree of stability as we find in aromatic compounds. It follows, therefore, that from the standpoint of the centric formula and of ring-tension only the benzene ring can be expected to be a carrier of the aromatic character, which is in entire agreement with the facts.

The last paper of the evening was presented by Dr. Stokes, and was entitled 'The Meta-phosphimic Acids.' The paper outlined an attempt to explain some of the properties of the meta-phosphimic acids by means of von Baeyer's tension theory. These acids have the general formula $(\text{PNO}_2\text{H}_2)_2$ and may be regarded as ring compounds. Regarding the rings as polygons, the acids actually studied are as follows, the angle between adjacent sides of the polygon and its difference from 135° , the angle involving the least tension being given:

	Angle between sides.	Difference from 135° .
$\text{P}_3\text{N}_3\text{O}_6\text{H}_6$	120°	-15°
$\text{P}_4\text{N}_4\text{O}_8\text{H}_8$	135°	0°
$\text{P}_5\text{N}_5\text{O}_{10}\text{H}_{10}$	144°	$+9^\circ$
$\text{P}_6\text{N}_6\text{O}_{12}\text{H}_{12}$	150°	$+15^\circ$
$\text{P}_7\text{N}_7\text{O}_{15}\text{H}_{16} = (\text{P}_7\text{N}_7\text{O}_{14}\text{H}_{14} + \text{H}_2\text{O})$	154.3°	$+19.3^\circ$

Of these acids $\text{P}_4\text{N}_4\text{O}_8\text{H}_8$ is vastly more stable than the preceding member and represents a maximum stability with a presumable minimum of tension. $\text{P}_5\text{N}_5\text{O}_{10}\text{H}_{10}$ is less stable than $\text{P}_4\text{N}_4\text{O}_8\text{H}_8$ but more stable than $\text{P}_3\text{N}_3\text{O}_6\text{H}_6$, while

the tension in the ring of $P_7N_7O_{14}H_{14}$ is too great to permit of its existence and it spontaneously takes up water, forming $P_7N_7O_{15}H_{16}$. A further confirmation is found in the fact that the higher members on decomposition in part close again to form the stable ring-acid $P_4N_4O_8H_8$, indicating a disposition to form rings containing P_4N_4 . An attempt to test this theory further will be made by endeavoring to prepare diphosphonitric chlorid, $P_2N_2Cl_4$. The corresponding meta-phosphimic acid, $P_2N_2O_4H_4$, should have the angle 90° , differing from the angle of least tension, 135° , by 45° . Such an acid should be much less stable than even $P_7N_7O_{14}H_{14}$ and should pass at once into $P_2N_2O_5H_6$.

WILLIAM H. KRUG,
Secretary.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, MAY 17.

MR. C. S. BOYER illustrated the structure and geographical distribution of diatoms by a large series of lantern views preparatory to describing the following new species: *Rhabdonema Woolmanianum*, *Biddulphia semicircularis Asburyana*, *B. argus*, *B. interrupta*, *B. keeleyi*, *B. Shulzei* and *B. verrucosa*. The paper, with figures, will be published in the *Proceedings* of the Academy.

MR. T. C. PALMER described and illustrated some of the phenomena of conjugation in *Closterium*. The essential steps are essentially as in *Spirogyra*, in that in both cases the process is at first a putting out of tubes which meet and fuse. But just as *Closterium* differs from *Spirogyra* in its method of cell-division, so it presents peculiarities in manner of formation of the zygospore. The two lobes of the desmid seem to possess a certain degree of individuality, at least at the period of conjugation. These lobes, owing to the peculiar method of growth of the plant, generally differ, at the time of conjugation, in age, and therefore in size, and in the thickness, color and markings of the cell-walls. The contrast between two ends or lobes of a given cell is often very great; and in *C. acerosum*, as a rule, each desmid first separates into two entirely distinct and independent semi-cells, each of which is beautifully rounded off at its blunt end by a new growth of cell-wall. The young semi-cell of each desmid then conjugates

with the old semi-cell of the other, and two perfectly distinct zygospores are thus formed. These zygospores and the empty semi-cell cases are held together by a nearly or quite invisible jelly. The 'individuality of the semi-cell,' a tendency toward which has been remarked upon heretofore by Mr. Archer in the case of *C. lineatum*, here becomes practically complete.

In one instance *C. acerosum* formed three zygospores instead of two. One of these was the usual size, made up of the commingled contents of an old and new semi-cell. The other two were about half the size, and consisted each of the unmixed contents of another semi-cell. Of a similar nature is the recently observed discharge, without conjugation, of the contents of a whole cell in *C. lineatum*. The protoplasm, containing small round or ovoid bodies like those in the ordinary zygospore, issued from the ruptured union of the semi-cell cases. It assumed a spherical form. Its development could not be followed further.

The development of the zygospores of *Closterium* is not thoroughly well understood, but the phenomena are probably similar to those of the germination of *Cosmarium*. In addition, however, to this process, another method of reproduction is suspected in *Closterium*, of which the discharge of the cell-contents without conjugation may be one of the stages.

Many of the phases of reproduction in the desmids may be observed to advantage by placing zygospores in life-slides and following the changes that ensue. In such slides large numbers of very minute *Closterium* frequently appear, and these grow perceptibly from day to day, but it is not certain, or even probable, that these arise from the ordinary zygospore.

The following papers were presented for publication in the *Proceedings*:

'Descriptions of five new Phyllostome Bats,' by Gerrit S. Miller, Jr.

'Chitons collected by Dr. Harold Heath at Pacific Grove, near Monterey, Cal.,' by H. A. Pilsbry.

EDWARD J. NOLAN,
Recording Secretary.

Erratum: In the review of Wilder's System of Nomenclature, p. 716, col. 1, line 5, for 'chippocamp' read 'hippocamp.'